Status of coal and biomass co-combustion in Europe

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Compared to other renewable energy sources, the thermal use of biomass or bio-waste fuels, represents a cheap and technically feasible option to contribute to the reduction of the global CO_2 emissions, a main goal of the Kyoto protocol. Therefore, the target of the European Union defined in the White Paper is to increase the share of biomass on the primary energy consumption from 3,1 % in 1995 up to 8,5 % in 2010.

From a ecological and economical point of view the co-utilization of biomass fuels in large scale coal boilers is one of the most attractive possibility. Furthermore, co-combustion of biomass or bio-wastes together with coal in large-scale firing systems offers several advantages, such as the possibility to utilize large quantities of biomass at low co-combustion rates in state of the art combustion systems, lower investment costs and higher conversion efficiencies compared to systems exclusively fired with biomass, etc. Therefore, biomass co-firing activities, both in retrofit and new plants, are expected to expand significantly in the world within the next years contributing to the above mentioned goal.

Pulverized fuel firing systems are the most common in power plant technology and co-combustion in these boilers is an attractive option to reduce the emissions of the greenhouse gas CO_2. Besides the mentioned pulverized fuel-firing systems fluidized bed boilers are also considered as a suitable technology to co-utilize biomass for heat and power production. However, the co-utilization of biomass or bio-wastes in coal firing systems has consequences on combustion behavior, emissions, operational conditions and residual matter. Therefore, some kind of biomass fuels require additional measures like pretreatment by e.g. gasification or pyrolysis prior to the use in a combustion system.

Based on the experience of the APAS research program the objectives of recently concluded and ongoing EU co-founded projects were to concentrate the research efforts on the problem areas like slagging, fouling, corrosion, ash utilization and trace emissions for different co-combustion systems and to investigate in detail technical options to avoid these negative effects. Major operational problems like slagging, fouling and corrosion were investigated both in PF dry ash removal and slag tap combustion systems depending on fuel blend and blend ratios. The effect of co-combustion on the by-product utilization and disposal are evaluated by analysis of a variety of ash samples from the experiments and compared with a pure coal or pure biomass combustion system. The solution of these technical problems is essential for a technically and economically feasible and environmentally advantageous co-utilization of fossil and renewable fuels and will promote a widespread utilization of existing biomass resources.

Besides using solid pulverized biomass as an additional fuel in coal-fired boilers a further possibility to run a combined coal and biofuel process is to pre-pyrolysis or pre-gasify biomass and to use the gas as re-burn fuel in the coal-fired boiler. Within the pretreatment process the solid feedstock is separated into a high energy gas and a solid residue. The gas can be used as re-burn fuel with excellent NO_x reduction properties, the solid residue can be used in further processes or has to be disposed. By thermal pretreatment of biomass by the means of pyrolysis or gasification the problems of the direct co-combustion process considering the combustion behavior and operational conditions shall be minimized. The pretreatment process has the advantage that undesired components, like alkaline and chlorine

compounds, can be kept away from the coal-fired boiler. Furthermore, the separation of coal and biomass ash within this co-combustion process enables a specialized use of both residuals.

The intention of this presentation is to define phenomenological and fuel dependent restrictions and to point out possible solutions for the prevention of operational problems in order to propose the best suitable and most economical technique. Additionally, within this paper an overview of recent co-combustion activities will be given and the situation of co-combustion in Europe, especially in Germany and The Netherlands will be discussed in detail. The presented overview will include a variety of different biomass and bio-waste fuels for co-utilization such as wood, straw, short rotation coppices, annual crops, sewage sludge, etc. Finally, the inclusion of recent results from R&D in combination with information and experiences from existing and planned large scale projects will give an comprehensive overview of the actual status of coal/biomass co-combustion in Europe.